Chapter

Nutritional Quality of Wheat

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Abstract

The criteria of wheat quality are varied, which is suitable for one product may not have properties for another product. Wheat endosperm contains the proteins, carbohydrates, iron, and B-vitamins such as riboflavin and niacin. It also contains soluble fiber as well as trace minerals. Soluble fiber is considered to have health benefits that are not shared by insoluble part. It is the leading source of vegetal protein in human food, having a protein content of about 13%, relatively high as compared with other major cereals**.** Natural wheat has a number of medical properties, such as every component of the whole wheat grain contains elements that the person's body requires. Wheat comprises carbohydrates and gluten protein, which offer massive amounts of energy; inner bran coats, phosphates, and other mineral salts; and dietary fiber, which helps with bowel movements. Wheat protein and vitamins B and E aid to develop and rebuild muscle tissues. The wheat germs that are eliminated during the purification process are also high in important vitamin E, which could also lead to heart disease if not consumed. Constipation and other gastrointestinal disorders and nutritional diseases are common as a consequence of the lack of vitamins and minerals in refined wheat flour.

Keywords: wheat bran, nutritional quality, wheat varieties, gluten proteins, medicinal properties

1. Introduction

Wheat (*Triticum spp*.) is cereal crop that belong to the family *Poaceae* (order *Poales*). Wheat is a staple source of nutrients for around 40% of the world's population. Wheat has already been cultivated for millennia. Wheat was among the first cereals crop to be farmed, and that has been a staple diet throughout Europe, Western Asia, and Northern Africa for over 8000 years. This is most likely due to wheat's agricultural versatility, convenience of grain storage, and simplicity of flour conversion for a variety of cuisines. Wheat is probably the most frequently produced crop in the world, with over 218 million hectares under cultivation, and its global trade exceeds that of all other crops collectively. Wheat is a vital aspect of human diet, accounting for 20% of daily calories and protein. Wheat is indeed the second most powerful food crop in the undeveloped nations after rice in ensuring food security, with an estimated 80 million peasants depending on it for their survival [1].

1.1 Origin and evolution of wheat

About 10,000 years ago, the wheat was cultivated for first time, as part of the "Neolithic Revolution," which witnessed a shift from hunting and gathering to organized agricultural production. These early farmed wheat varieties were diploid (genome AA) (einkorn) and tetraploid (genome AABB) (emmer), and their hereditary linkages imply that they emerged in Egypt's south-eastern region. When hexaploidy bread wheat finally originated about 9000 years ago, cultivation had expanded to the Near East. Due to its high productivity and other quality parameters, landraces were selected by agriculturalists from wild inhabitants. It was considered as plainly nonscientific method of plant breeding. On the other hand, selective breeding or domestication was also responsible for genetic feature selection that distinguished them from their wild ancestors. Others have gone into further depth about the domestication disorder, but two characteristics stand out as particularly important. The first one is the failure of a spike to rupture as it reaches maturity, and this is main cause of seed loss during harvest. The non-shattering feature is regulated by mutations at the brittle rachis (Br) gene. It is a crucial trait for guaranteeing seed distribution in natural populations. The second important feature is a transition from hulled forms. In this condition, the glumes are securely bound to the grain, to free-threshing exposed forms. When a predominant mutation occurred at the gene Q, it improved the impact of recessive mutations at tenacious glume locus or Tg locus. All cultivated forms of diploid, tetraploid, and hexaploid wheat have a strong rachis, aside from the spelt bread wheat strain. Moreover, einkorn, emmer, and spelt really are hulled early cultivated varieties. On the other hand, modern tetraploid and hexaploid wheat varieties are free-threshing. Einkorn and emmer had been domesticated from natural populations. Bread wheat, despite einkorn and emmer, has been grown in agriculture for a long time. Bread wheat has been developed created by crossing cultivated emmer with an unrelated wild grass named *Triticum tauschii* (also called *Aegilops tauschii* and *Ae. squarrosa*). A novel hexaploid genome AABBDD was selected by the researchers due to their superior qualities, and this hybridization probably occurred numerous times separately. As compared with batter adapted species, the modern wheat species are unable to live in wild because during the adaption, genetic changes occurred. In the 1880s, John Bennet Lawes beautifully proved this by enabling a portion of Rothamsted's famed long-term Broadbalk experiment to revert to its original state. As a result, in 1882, he left a portion of the wheat crop unharvested and tracked its progress throughout the years. Weeds took over after a successful crop in 1883, and the few remnant wheat plants (spindly with little ears) were removed and photographed in 1885. The genomes of tetraploid and hexaploid wheat are closely related to wild and cultivated einkorn A genomes. It was investigated that the D genome of hexaploid wheat is obtained from T genome tauschii. The B genome of tetraploid and hexaploid wheat, on the other hand, is most likely derived from the S genome found in Aegilops' Sitopsis portion, with Aegilops speltoides being the closest existing species. Ae. speltoides' S genome is also the most similar to T. timopheevi's G genome, a tetraploid species possessing both the A and G genotypes [2].

1.2 Cultivated wheat today

Hexaploid bread wheat currently accounts for 95% of global wheat output, while for the leftover, 5% tetraploid durum wheat was taken into consideration. Durum wheat is batter adapted in dry Mediterranean climate than bread wheat. It is

commonly known as pasta wheat. It is utilized to bake bread and also used in South Africa to prepare regional cuisines. These regional cuisines include couscous and bulgar. Faro is the Italian name for wheat varieties such as einkorn, emmer, and spelt. These wheat verities are still cultivated in small quantities in some areas, including as Spain, Turkey, the Balkans, and the Indian subcontinent [3].

1.3 Why has wheat been so successful?

Despite its recent origins, bread wheat has enough genetic variability to allow the formation of approximately 25,000 varieties that are adapted to a variety of temperate climates [4]. If enough water and mineral fertilizers are available, as well as good pest and pathogen control, yields can surpass 10 tonnes per hectare. This is why it became more favorable in temperate climates as compared with other crops. Wheat is harvested by two methods such as conventional method and mechanical combine harvesters. If pests and water content were controlled, then wheat can be stored properly. For wheat storage, moisture content should be less than 15% [2].

2. Types of wheat

Wheat is divided into three categories: species, commercial types, and growth habits. There are 16 species based on these, two commercial forms are available: one is bread (*Triticum aestivum*), and second one is macaroni (*Triticum durum*), and three growing patterns (winter habit wheat, spring wheat, and facultative wheat). Winter wheat lies dormant during a winter freeze.

2.1 Major cultivated species of wheat

*2.1.1 Bread wheat (*T. aestivum*)*

T. aestivum is known as bread wheat that produces about 95% of total wheat. *T. aestivum* (bread wheat L. 2n = 42, hexaploid, AABBDD genomes) is classified into hard wheat and soft wheat depending upon the grain hardness. Bread wheat is used as flour that is used in many types of food diversity and baked products.

*2.1.2 Pasta wheat or durum wheat (*T. durum*)*

T. turgidum *L. var. durum Desf.* (2n = 28, tetraploid, AABB genomes) accounts for roughly 35–40 million metric tonnes of total global production. This variety is adapted in hot and dry conditions. Mediterranean Sea includes the wheat-cultivated countries. This tetraploid variety of wheat is used to synthesize pasta so that it's called as pasta wheat. In the Middle Eastern countries, durum wheat is ground into the flour and used as feed, and grain grits are also used in the Saudi Arabia [5]. Other species of wheat is less important; these species are cultivated according to the demand of market.

These are the following:
Einkorn is diploid species.
Emmer is tetraploid variety.
Spelt is hexaploidy variety.

Spelt, emmer are different from other varieties because their grains are not obtained by threshing. Harvesting of grains is classified as properties of wheat according to marketing point of view. Purchasers' classification of wheat is different according to uses and cultivation and profit [1, 6]. For the sake of the marketplace, cultivated wheat grain that undergoes trade is categorized based on grain qualities. Wheat buyers have been using categorizations to help them decide which wheat to buy because each category has its own set of applications. With this technique, wheat growers may identify which wheat varieties are perhaps the most lucrative to cultivate.

2.2 Classes used in the United States are

2.2.1 Durum

Semolina flour is made from quite a rigid, transparent, luminous grain.

2.2.2 Hard red spring

Bread and firm caramelized items are made with a hard, brownish, protein rich wheat. Hard red springtime wheat is often used to make baking powder and high-gluten flours. The Minneapolis Grain Exchange is where it's mostly exchanged.

2.2.3 Hard red winter

Rigid brown and highly protein wheat grains are used for bread and bakery products. This flour is used as protein agent in the pie crusts. Hard red wheat is used as unbleached form in the market and traded by Kansas City board of trade.

2.2.4 Soft red winter

Cakes, biscuits, muffins, and pastries are made using a low-protein wheat. With bakery products, you can use cake flour, pastry flour, self-rising flour, and pastry flour. The Chicago Board of Trade is the market for it.

2.2.5 Hard white

Hard and light in color, not transparent, white, and less protein. This variety is dry and present in temperate grassland that is used for the bread and brewing.

2.2.6 Soft white

This variety is of white color and very soft containing less protein and grown in the moisture places. Soft white wheat is used for pie and pastry. This variety is very expensive in the market and has a great demand [7].

3. Uses of wheat

Wheat is a valuable source of carbs in most developed nations and globally protein source used for human food, animals used it as dietary fiber. It contains minerals, fat,

and vitamins, which are source of micronutrients and dietary fiber. Meat-based diet is less important than the wheat-based diet [6, 8, 9]. It is fruitful for the heath, which is approved by EFSC; the wheat fiber is very important for the diarrhea glucose response and cholesterol control. The significance of wheat is shown by the EU framework 6 in the Healthgrain Program [1]. Dough is the sticky flour after water mixing that has viscoelastic characteristics [10]. Due to fermentation, it has some swelling problem used in the bun and bread and releases the carbon dioxide [11]. Gluten polymer is related to the coeliac disease, a chronic inflammation that affects the European countries. Respiratory system is also infected, and food allergies are related to wheat [12]. Other wheat-related disorders, such as asthmatic and food sensitivities, have been reported, prompting a lot of wheat investigation in the human healthcare profession. Wheat demand has been increasing over the world, particularly in countries where agricultural production is difficult. Consumption is increased worldwide, and production is affected by climate change. Wheat is also used for animal's feed. Some low-quality wheat is used in the industry to make glue, paper adhesive, and several other products such as alcohols [1].

4. Wheat gluten proteins and processing properties

Dough formation of wheat from wheat grains has been used in the formation of bread, biscuits, cakes, pasta, noodles, and pastry that make the wheat superior to other crops of template areas. The wheat dough has the ability to store the protein, which forms gluten.

Gluten is the best protein fraction that was discovered by chemist Baccari in 1728. This was prepared by washing the wheat and preparing the dough and adding the salt solution that contains cohesive mass, which has 75% protein and starch. The gluten protein is prepared in an essential pure form by simple method depending upon the characteristics. First, they are insoluble in water and soluble in alcohol that was called as prolamin. Second, the individual gluten protein has strong covalent bond force, which permits the gluten protein to separate as a cohesive mass. Gluten protein has high biological and chemical importance that can be discussed in the literature [2].

4.1 What is the origin of gluten?

In the endoplasmic reticulum, gluten releases the protein during the protein synthesis that was transferred to lumen of endoplasmic reticulum and stored. Storage protein follows the two routes:

Golgi-dependent route.

Golgi-independent route [13].

4.2 Nutritional contents

Wheat is essential for the health of people due to having a large number of diet contents and nutritional value. Its important can be guessed to see the developed countries that can use only bread, noodle, cakes, pastry, and lactogen. Carbohydrates 55% and 20% of food calories are present in the wheat grains. Carbohydrates 78%, protein 14%, fat 2%, minerals 2.5%, and vitamins such as thiamine and vitamin B, as well as minerals such as zinc and iron, selenium, and magnesium make up a small percentage of the diet [14–16]. Wheat has pericarp that is classified as true seed.

Protein is stored in the endosperm; the protein contents are about 72%. Wheat grains are also rich in pantothenic acid, riboflavin and some minerals, sugars, etc. The barn, which consists of pericarp Testa and aleurone, is also a dietary source for fiber, potassium, phosphorus, magnesium, calcium, and niacin in small quantities.

Wheat kernels are a treasure trove of nutrients important to human nutrition. Endosperm accounts for around 83% of the weight of the kernel and is the origin of white flour. The endosperm comprises the majority of the protein, carbohydrates, iron, and numerous B-complex vitamins such as riboflavin, niacin, and thiamine in the total kernel. Bran makes up roughly 14.5% of the weight of the kernel [17–20]. Bran can be present in the whole wheat flour and can also be purchased individually. Protein is present in small amounts in the bran and significant amounts of the B-complex vitamins described above, trace minerals, and indigestible cellulose fiber termed dietary flour, among the nutrients in the whole wheat. Wheat germ is the wheat kernel's embryo. High amount of protein, lipids, and numerous B vitamins is present in wheat germ and embryo [21]. Wheat germ is high in minerals and low in salt and cholesterol. It is high in vitamin E, magnesium (Mg), thiamin, pantothenic acid, niacin phosphorus, and zinc (Zn) as well as small amount of ubiquinone (ubiquinone) and PABA (para-aminobenzoic acid) are found in it [15, 19, 22].

Wheat germ is abundant in fiber, with 1 g per tablespoon. A high-fiber diet can help regulate immune function (i.e., reduce constipation) and may be suggested for individuals who are at risk for colon disease, heart disease, or diabetes.

5. Types of wheat flours and its uses

5.1 All-purpose flour

Endosperm of the wheat kernel is used for all-purpose flour, and it is separated from barn and germ during grinding process. Hard wheat is used for the manufacturing of all-purpose flour. It can be prepared by using a blend of soft and hard wheat. So, it can be used for varieties of baked food such as noodles, cookies, cakes, pastries, and yeast breads.

Enriched all-purpose flour is fortified with iron and B vitamins in proportions that are equivalent to or greater than whole wheat flour. Enriched bleached all-purpose chlorine is added to flour to help it develop, shape the gluten, and enhance the cooking condition. Despite the fact that chlorine somehow does not kill the nutrients, it does reduce the risk of degradation or contamination. Enriched unbleached all-purpose flour is off-white in appearance after being discolored by oxygen in the atmosphere during the aging. Unbleached and bleached flour are similar according to the maturational value.

5.2 Bread flour

From the endosperm of the wheat kernel, bread flour is obtained. It is mostly used by commercial bakers and major retailers. It has a higher protein concentration than all-purpose flour. It is typically used for breadmaking process.

5.3 Self-rising flour

When salt and baking powder were added in all-purpose flour then, this flour is known as self-rising flour. It's one cup containing 11/2 teaspoons baking powder and

1/2 teaspoon salt. If you modify the salt and baking powder quantities, you can use self-rising flour instead of all-purpose flour in a recipe.

5.4 Whole wheat flour

Whole wheat flour has a rough appearance and contains endosperm of the wheat kernel, germ, and barn. Gluten development is slowed when bran is present. Whole wheat flour–based baked goods are often heavier and thicker than white flour–based goods.

6. Other flours

6.1 Cake flour

Soft wheat flour was used in the milling process. Cakes, cookies, crackers, and pastries are all good candidates. Gluten-free and low in nutritional value.

6.2 Pastry flour

Wheat flour that is gluten-free and silky smooth and used in the milling process. Protein content is comparable to cake flour; however, carbohydrate content is lower.

6.3 Gluten flour

Bakers use it in conjunction with low-protein flours to improve baking efficiency and generate massive gluten bread.

6.4 Durum flour

Produced as a by-product of semolina production. Used to create commercial noodles in the United States.

6.5 Farina

Hard wheat endosperm that has been coarsely mashed. Many breakfast cereals in the United States contain this component. It's also used to make low-cost pasta with a low saturated fat content. There is no cholesterol, low sodium, and sugar-free, but it contained high Mn, P, and dietary fibers [23].

7. Medicinal properties of wheat

Wheat has various therapeutic properties when grown naturally. The nutrients that are required by human body all are present in the whole wheat grain. Wheat provides heat and energy through starch and gluten. Phosphates and other mineral salts are found in the inner bran coatings. The outer bran provides much-needed supplements and the nondigestible component that facilitates digestion. Wheat germ, vitamins B and E, and protein assist the development and muscle recovery. Wheat germ, which is extracted during the purification process, is high in important vitamin

E, which can cause heart disease if not consumed. Constipation and other gastrointestinal problems and nutritious diseases have become more common as a result of the lack of vitamins and minerals in refined wheat flour. Whole wheat protects against various illnesses such as constipation, heart disease, diverticulum, obesity, appendicitis, ischemia, and diabetes [24]. There have been several claims linking wheat, specifically wheat gluten, to a variety of medical disorders, extending from unlikely tales in the mainstream media to science research [25]. Autoimmune illnesses such as rheumatoid arthritis, which could be more common among celiac patients and family, are among them [26]. It may be easier to imagine pathways for links between disorders with a comparable immune background than it is to explain the well-known link across wheat, celiac disease, and schizophrenia. Others with sporadic idiopathic ataxia (gluten ataxia), migraines, acute psychoses, and a variety of neurological disorders have been documented [23].

The phenolic acid cross-linking may limit the health benefits of soluble fiber, which are not shared by insoluble fiber. Insoluble fiber, on the other hand, may help transfer phenolic antioxidants to the intestine, potentially lowering the risk of colorectal cancer [17, 27, 28]. Some doctors prescribe a gluten-free, casein-free diet because of the link with autism. Some of these effects are immune-mediated, while non-immune-mediated effects are extremely impossible to articulate and evaluate. They could be caused by the release of bioactive peptides. These peptides are produced from gluten protein. Gluten is an important source of large number of peptides such as opioid peptides [28] as well as an angiotensin-converting enzyme inhibitor [29].

7.1 Wheat bran

Use of wheat barn as dietary fibers helps in the prevention of various gastric and digestive ailments. Some of these are cancer of colon, intestinal cancer, irritable bowel syndrome (IBS). In addition to these, wheat barn also aids in diminishing the risk of hemorrhoid and hiatal hernia, hypertension, breast cancer, hypercholesterolemia, gallbladder diseases, and type 2 diabetes [24, 30]. Being rich in iron and phosphorus, it helps in easing the consumption by increasing stool output and bowel frequency. It has a lot of fiber on the exterior, which helps to balance nutrient uptake and excretion.

7.2 Wheat germ

Wheat germ is a rich source of a number of vitamins and minerals, which has increased its employment in both skin care lines as well as for persons of all ages as a source of nourishment. Its antibilious, antihidrotic, antivenous, vitamin E and minerals such as Zn, Fe, Cu and Mg. Its oil extract is also a huge source of vitamins such as E, D, and A, protein contents, and lecithin. In the vast field of skin care, germ oil finds its employment as anti-skin irritant and alleviates skin dryness and cracking. Due to its antioxidant properties, it finds wide application as carrier oil in number of products. Its external application to the skin increases and improves the circulation of blood, which in turn helps repair the skin damaged by harmful rays of the sun. Germ oil also aids in the prevention of dermatitis. The oil extracted from wheat germ has a shelf life of near about 6–8 months. Wheat germ also holds immense nutritional values as it contains fatty acids vital for healthy growth of the body. They form 3% by weight of the grain but contain only 26% of vitamins, proteins, and minerals.

Being rich in various vitamins and minerals, it gives very good results even with lesser amount and is generally added as carrier oil [23].

7.3 Wheat stem, fruit, and seed

Different parts of the wheat have different nutritional and medicinal properties. Employment of young stems of wheat in curing of biliousness and intoxication is widely known. Removal of skin blemishes is done by using ash. Wheat fruits have antipyretic and sedative properties. The light grain has antihidrotic properties. It treats the night sweats and spontaneous sweating.

Sex harmones in the seed are used in China and are believed to increase the fertility of the female. The seed sprouts have antibilious and vinous and constructive characteristics. Diseases such as malaise, sore throat, abdominal coldness and spasms, constipation, and cough can be treated using the seed sprouts of wheat. The plant of wheat is also believed to contain anticancer properties [18].

8. Ways to treat some common aliments

8.1 Internal rejuvenation

The 8% protein content of wheat comprising eight essential amino acids has phenomenal rejuvenation properties. The essential amino acids are present in a perfect and delicate percentage and offer amazing healing effects ranging from skin to muscular and all other organ systems. Firstly, the protein content of the wheat is metabolized into amino acids. This nourishes the heart and lungs, healthy skin and hair, tendons and ligaments, brain, central nervous system, and glandular network, as well as forming durable muscles and clearer vision. The energy and nutritive benefit that come with the wheat are because of B-complex vitamins, especially thiamin, riboflavin, and niacin, rejuvenating the skin and circulatory system. In addition to all these nutritional benefits of wheat, it also nourishes the hormonal system, which in turn helps in healing the wounds and regulating the blood pressure. Wheat contains nutrients that are important for maintaining internal water equilibrium, such as Fe, P, and K. Wheat thus aids in the restoration of internal balance [21, 27].

8.2 Tooth disorders

As chewing wheat consumes some time, it helps in exercising the teeth gems, which acts as a facial exercise too. When eaten along with other food items, it promotes the chewing of other food too, which eases up the process of digestion. This juice of wheat acts to relieve sore throat and pyorrhea. Chewing wheat grass cleanses and draws the toxins and bacterial growth in the gums, thus preventing tooth decay and tooth aches.

8.3 Constipation

In milling process of flour, bran of wheat is considered as a by-product and is complete in nutrient values as compared with flour. It has qualities of being best agent to treat constipation. Fruits and vegetables are also taken for this purpose but are less effective than bran. Bran is concentrated in cellulose, which exists in massive form

in the intestine and has a function to inhibit as well as to cure constipation. It has efficiency in removal of constipation by continuous elastic contraction and relaxation of the intestine.

8.4 Skin diseases

Chlorophyll inhibits bacterial growth, which causes diseases in organisms. Normal activity and growth of cells are important for a healthy skin. If growth became abnormal or affected because of bacterial cells, then wheat grass therapy is used to stop the bacterial cells nourishment. In this therapy, intake of wheat grass juice is recommended. This flour is used to cure wounds and ulcer. A paste of wheat flour, vinegar by boiling these together is used if a surface burns or itching occurs. It also acts as sterilizer.

8.5 Digestive system disorders

There are many disorders in digestive system and tracts. Wheat grass juice is used to cure these disorders. Enema is given to get rid of constipation. For this purpose, first of all, neem water is given, then 90–120 ml wheat grass juice is given after 20 minutes. This will treat sickness in colon, ulcerative colitis, and mucous.

8.6 Circulatory disorders

For treatment of circulatory diseases, wheat grass juice is taken. Wheat is rich in chlorophyll and improves working of the lungs and heart as chlorophyll is rich in hemoglobin (iron). It will lower down the effect of CO_2. Because of these advantages, wheat grass juice is of immense importance [31].

8.7 Wheat for treating boils

For the treatment of boils, which have pus in them, formerly, this was done by surgeon's knife. But now wheat flour is used. Alse (from shop) is grounded in powder form and added in fried wheat flour. Add one table spoon of water in it. Allow this mixture to thick with continuous stirring. Allow it to cool down. Bandage was made by this paste and bound on the boil. This will prove to be beneficial and provide relief. Warm water is used to wash the boil. Ointment is used on daily basis. Clean it on daily basis.

8.8 Wheat for treating scars

Wheat flour for treating scars is commonly in use. Grounded paste of roasted wheat flour is made. Oil is extracted from this paste by pressing paste between a thin cloth. This oil treats itching.

8.9 Wheat for curing chest pain

Wheat flour is used for curing chest pain. Paste is made by heating wheat, barn, and coarse salt. Paste is placed on a bandage and rubbed on the chest. This will provide relief.

8.10 Wheat for tonsil pain

Wheat flour is used for treating tonsil pain. This is treated by making a halwa by heating wheat flour and water. This paste is placed in a bandage and placed on a tonsil.

8.11 Wheat for treating acne or pimples

Using whole wheat flour, make a fine paste. On pimples, apply this paste after being kept 1 h in the refrigerator. After that, simply wash it away. Make a habit of it.

A meta-analysis of data from much more than 30 well-designed animal studies examining the anticancer properties of wheat bran, the section of the grain with the largest amount of the insoluble dietary fiber's cellulose and lignin, was published in 1998 by scientists at Wayne State University in Detroit. They concluded that animals-provided wheat bran had a 32% lower risk of colon cancer, and they want to do a meta-analysis of human research to confirm their findings. Wheat bran (WB) proved to be more important than oat or maize bran at controlling colon tumorigenesis.

9. Other uses of wheat

Straw can be used for a variety of purposes, including biofuel, thatched roofs, and garden mulch. Paper is made from a fiber collected from the stems. After the seed has been gathered, the stems are split into usable pieces and steeped for 24 h in clear water. The fibers produce a tan-green paper. Laundry, resizing textiles, and other uses for the seed's starch. Chappatis are a popular wheat-based dish in India, Pakistan, and Iran. Dalia would be a whole flour that is used to make them. Wheat in the crushed form known as Dalia is particularly nutritious. In the past, it was a highly popular Indian meal. It's made by immersing two tablespoons of crushed or shredded wheat in water for 30 minutes and then slowly boiling it until the water almost evaporates. After that, to taste, add milk and honey. It's a healthy breakfast option. However, fresh data from the long-running Nurses' Health Study at Brigham Women's Hospital/Harvard University School of Public Health discovered that women who ate a high-fiber diet had the same risk of colon cancer as those who ate a low-fiber diet in early 1999. Investigators are expecting confirmation proof before modifying dietary requirements because this study conflicts hundreds of others performed over the previous 40 years [23].

A meta-analysis of findings from more than 30 well-designed animal experiments examining the anticancer impacts of wheat bran, the component of the wheat with the greatest percentage of the insoluble dietary fiber's cellulose and lignin, was published in 1998 by scientists at Wayne State University in Chicago. They discovered a 32% significantly lower risk of colorectal cancer in animals fed wheat bran, and they want to do a meta-analysis of research involving human subjects to confirm their findings. Wheat bran is abundant in the whole flours. Wheat bran (WB) proved to be more effective than oatmeal or maize bran at inhibiting colorectal cancer. According to Liu et al. (2021), overconsumption of whole grains and dietary fiber has been linked to a lower incidence of liver cancer and chronic liver disease mortality. According to the researchers, primary liver cancer is the most common malignancy and the third largest cause of cancer-related death globally, and its number of fatalities has been on the rise in the United States. Liver cancer 5-year survival rates

increased from 11.7 to 21.3% between 2000 and 2011, illustrating the importance of prevention and treatment for this lethal illness [31].

10. Chemical composition and nutritional quality of wheat

Wheat is one of the most extensively grown staple foods on the planet. Wheat grains may be treated into semolina, flours, and other products, which makes it very essential component for employing its nutrients in numerous of meal items including bread, pasta, and other bakery products. The granules of different wheat kinds come in many different shapes. They are long, cylindrical, and narrowly flattened, although they have always been thought to be oval in shape. The grain is 5–9 mm long, weighs 35–50 mg, and also has a wrinkle down one side where it has been formerly linked to the wheat flower. It contains 13–17% bran, 2–3% germ, and 80–85% floury endosperm. Barn covers the grain's inner half and is made up of multiple layers of cells rich in minerals and vitamin B. Since many bran fibers are insoluble in water, it can preserve the interior region. Pentosans, cellulose, and polymers based on arabinose and xylose, all of which have been firmly bound to proteins, constitute this fiber's chemical content. Bran dry matter contains minerals, proteins, and carbohydrates 72% and 16%, respectively. Certain amino acids in the outer layer of endosperm and flour are in remarkably different proportions. Glutamine and proline concentrations are about half; however, arginine concentrations are tripled, and alanine, asparagine, glycine, histidine, and lysine levels are all doubled of what they have been in wheat flour. Aleurone has the largest concentration of proteins and enzymes; these enzymes and proteins are required for germination. It is also high in dietary fibers and contains fats, proteins along with ash 1.5%, 13% and 0.5%, respectively. It also has a high concentration of vitamin E. The valuable nutritional contents of the edible wheat have been listed in **Table 1**.

10.1 Protein composition of wheat

Wheat contains between 10% and 18% protein by dry weight basis. The distinct protein fractions that can be isolated from powdered wheat include albumins, glutenins, globulins, and gliadins. Albumin is water-soluble, glutenins are soluble in dilute acid or NaOH solutions, globulins are insoluble in water but soluble in a dilute NaCl solution, and gliadins are soluble in 70% ethyl alcohol. Albumins and globulins are prominent in seed coats, aleurone cells, and germs. Gliadins and glutenins are storage proteins make up for 75%, while globulins and albumins only comprise 25% of overall amino acid composition. The storage proteins such as gliadins and glutenins are absent in seed coat layers and germ but occur abundantly in the mealy endosperm.

10.2 Carbohydrate composition of wheat

In most cases, the polymerization of glucose monomers culminates in starch production, and this starch is stored energy form of cereals. Amylose and amylopectin were discovered to be two different forms of polymers based on their chemical composition. Amylose has a mostly linear structure that results from the 1,4-linkage of monomer units comprising 1000–5000 glucose units. Amylopectin is branched polymer, which contained 20–25 glucose monomers in each chain. Under normal

S#	Nutritional value of wheat	Units	White wheat flour	Whole grain flour
1	Energy	kcal	364	340
2	Protein	gm	10.3	13.2
3	Total fat	gm	1.0	2.5
4	Carbohydrates	gm	73.6	61.3
5	Fiber	gm	2.7	10.7
6	Calcium	mg	15	34
7	Iron	mg	1.2	3.6
8	Magnesium	mg	22	137
9	Phosphorus	mg	108	357
10	Potassium	mg	107	363
11	Sodium	mg	2.0	2.0
12	Zinc	mg	0.7	2.6
13	Thiamin (B1)	mg	0.1	0.5
14	Riboflavin (B2)	mg	0.04	0.2
15	Niacin (B3)	mg	1.3	5
16	Vit. B6	mg	0.04	0.4
17	Folate	DFE	26	44

Table 1.
*Nutritional facts of wheat (*USDA datasheet).*

circumstances, wheat grain comprises approximately 20–30% amylose and 70–80% amylopectin. Starch makes between 60 and 75% of the dry weight of wheat. Wheat seeds come in two sizes: one is small (5–8 m), which is spherical in shape; and second one is large (25–40 m), which is lenticular in shape; and they develop 15 and 10–30 days after pollination, respectively. The smaller one takes up approximately 80% of the casing.

10.3 Fatty acid composition of wheat

Fatty acid (FA) synthesis rates in ripe wheat seeds fluctuate. Wheat requires the chemical component for lipid synthesis known as acetyl coenzyme A. Glycerides, phospholipids sphingosine, waxes, and the isoprenoid series are examples of synthetic compounds. Underdevelopment of malonyl-CoA, NADPH, dehydration, and condensation produce palmitic acid, which is then converted to stearic acid via a different mechanism. The germ contains the highest proportion of lipids 11%, while the endosperm's bran, proteins, and starch also have significant amounts. Majority of the binding lipids are phosphatidyl choline, phosphatidyl ethanolamine, phosphatidyl serine, and lysophosphatidic derivatives because they contain free -OH group on glycerol monomers-sitosterol, campestral, and saturated sterols C28 and C29 are the most common sterols. According to studies, the three fractions have a high level of linoleate (C18:2) and lesser amounts of palmitate (C16:0) in total lipids as well as triglycerides. It's composed of indigestible lignin and plant polysaccharide components in the human gastrointestinal tract.

10.4 Soluble dietary fibers

Pectic compounds and hydrocolloids are components that are soluble in water.

10.5 Insoluble dietary fibers

Components including cellulose, hemicellulose, and lignin are water-insoluble, and wheat grains are rich in insoluble fiber. Arabinoxylan is a type of insoluble fiber, which is regarded to be a suitable site for the fermenting of short-chain fatty acids (SCFAs), especially butyrate. Because butyrate fermentation took place in the colon, we might conclude that there is an abundance of butyrate in the colon. Butyrate is hypothesized to promote bowel health and lower cancer risk through a range of techniques when found in excessive amount in the colon. Dietary fiber consumption has numerous benefits, including prevention against cardiovascular disorders, serum cholesterol stabilization, glucose uptake and increased insulin modulation, and prevention of constipation and diverticular disease. The increased awareness of the possible health advantages of high-fiber diets has inspired a spike in interest in whole-grain and bran bread consumption. Phytates are potentially hazardous compounds present in high quantity in whole wheat flours. The bulk of inorganic phosphorus (Pi) is stored as phytate in mature grain seeds, which produces complexes with minerals such as Ca^{2+}, Fe^{3+}, Zn^{2+}, and Mg^{2+}, lowering their bioavailability. Soluble fibers such as (13,14)-D-glucan (also known as -glucan) have been shown to have immunostimulatory characteristics and to affect glycemic, insulin, and lipid reactions to meals.

11. Micronutrient malnutrition

Micronutrient deficiency raises morbidity and mortality rates, lowers productivity levels, stymies national development efforts, leads to persistently high rates of population growth, and lowers the livelihood and standard of living for all those affected.

11.1 Zn deficiency

Micronutrient deficiency in Zn impacts both agriculture and individuals. Zinc deficiency is now widely recognized as a severe health risk factor and a major cause of mortality.

Zinc insufficiency is consistently ranked among the 20 most important aspects in the world, and fifth among the 10 most important concerns in developing nations, according to a WHO evaluation of the risk factors for the development of illnesses and disorders. Zinc deficiency is linked to a number of major health issues, involving delays in muscle hypertrophy, immune function, and level of academic achievement, as well as an increased risk of illness, DNA damage, and cancer development.

11.2 Fe deficiency

Fe deficiency has been associated to an increased risk of tissue hypoxia and heart failure in young newborns and pregnant women, both of which can result in death. The bulk of maternal deaths during childbirth is assumed to be caused by maternal anemia, which is aggravated by blood loss during labor, and 20% of all maternal deaths are caused by maternal anemia. Babies born to iron-deficient mothers are

frequently dwarfed and ill, and attention problems, poor fine motor skills, and loss of memory in children are all causes of Fe deficiency. Pregnancy-related iron insufficiency has been connected to permanent brain damage in the fetus as well as irreversible cognitive growth in their children. Iron deficiency in pregnant women has been associated to premature and low birth weight, which can lead to significant issues such as immunologic malfunction and development failure.

11.3 Fe and Zn contents in wheat

In whole grain wheat germplasm, the Fe and Zn percentages are substantial, as well as the effects of the climate on these values were studied. According to reports and surveys, Zn concentrations in various nations range between 20 and 35 mg kg^1. The majority of the seed-Zn is found in the embryonic and aleurone layer such as 150 mg kg^1, although the endosperm contains just a small amount such as 15 mg kg^1. Fe levels ranged from 28.8 to 56.5 mg kg^1 in wheat grain from plants grown in Mexico in 1994. Clearly, wheat germplasm has considerable genetic variability to considerably raise Fe and Zn contents in wheat grain.

11.4 Se contents in wheat

Because of its antioxidant, anticancer, and antiviral characteristics, selenium (Se) is a necessary component for humans and other species. According to one study, soils are typically deficient in bioavailable Se, resulting in Se deficiency in many countries' food production systems. Despite the fact that Se content in wheat grain fluctuates significantly, spanning from 0.02 to 0.60 mg kg1 for most of the world's wheat, an Australian study found that wheat accounted for almost half of most people's Se intake. Selenite is a mineral that is totally soluble and easily absorbed by plants, makes up the majority of Se in alkaline soils while in acidic soils, Se is usually found as insoluble selenides and elemental Se.

Selenites, which are completely miscible and quickly absorbed by plants, make up the majority of Se in alkaline soils. In acidic, poorly oxygenated soils, Se is usually found as insoluble selenides and elemental Se [32, 33].

12. Conclusion

Wheat is enjoyed by consumers around the globe in a wide variety of most suitable products such as breads, biscuits, cookies, cakes, noodles, breakfast cereals, etc. Many different types of bakery formulations have been developed in different regions of the world based on the traditional food habits of the people. The behavior of wheat flour dough under mechanical manipulation and the quality of the completed product are both influenced by the rheological qualities of wheat. As the baking industry gets increasingly mechanized, understanding rheological behavior and dough qualities becomes very critical. Water, sugar, yeast, oxidizing and reducing agents, and emulsifiers are some of the key ingredients used in bakery products to improve dough handling, taste, and life span. Nutritional quality of wheat is much important as it is basic staple food for the masses. Nutritional attributes play a vital role toward the health status of the consuming population, which ultimately affect the economy of the nation.

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